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PATENT APPLICATION
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**A METHOD AND APPARATUS
FOR ESTIMATING PRINTER RESOURCES**

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A METHOD AND APPARATUS FOR ESTIMATING PRINTER RESOURCES

1 The present invention generally relates to a print feature, and
2 more particularly to a device that estimates the printer resources required by a
3 printer to print a document and alerts a user who sent the document to the
4 printer in the event that insufficient resources are available to print the
5 document.

6 Conventional printers are not capable of estimating, in advance of
7 printing, the print resources, such as, for example, paper and toner required by
8 a printer to print a document sent to the printer by a user. As a result, the user
9 may send a document to a printer for printing only to find out that the printer
10 ran out of the resources necessary to complete the print job, i.e., to finish
11 printing the document, causing the resulting product to have an unacceptable
12 print quality. For example, if the printer's supply of paper runs out, the
13 resulting print job will be missing pages, and thus incomplete. Alternatively, if
14 the toner runs out or drops below a required minimum level, the resulting print
15 job may be partially or totally illegible. In either event, all or at least portions
16 of the unacceptable document must be re-sent to the printer resulting in a loss
17 of efficiency for the user and/or lost resources. For a document that is non-
18 critical, the loss in efficiency or resources may be tolerable. Such non-critical
19 documents may include, for example, documents that are short in length so that
20 reprinting the document results in wasting only a small amount of paper or
21 toner. In addition, non-critical documents may include documents that are not
22 time critical, i.e., are not required to satisfy an immediate deadline such that the
23 time required to re-print the non-critical document does not adversely impact
24 the user's ability to meet the deadline. However, the costs associated with
25 having to reprint a document that is either resource critical or time critical are

1 often intolerable. Such critical documents may include documents that are
2 lengthy or that are needed to satisfy an impending deadline.

3 Thus, there is a need in the art for a device that estimates the
4 resources required by a printer to print particular documents, such as critical
5 documents, sent to the printer by a user. However, conventional networks are
6 configured to send multiple print jobs originated by multiple users to a single
7 printer using a single print server. In particular, conventional network users
8 have access to one or more printers via a print server that is coupled to the
9 network and that is further coupled to the printer. The print server stores, in a
10 queued fashion, the print jobs or documents to be printed that have been
11 received from the network users and transmits the stored print jobs to the
12 attached printer for printing according to the order in which the print jobs were
13 received and stored in the print server. As a result, if a typical network
14 configuration is employed, determining whether a printer has sufficient
15 resources to successfully print a critical document that is preceded in the print
16 server by, for example, three other non-critical documents requires an
17 estimation of not only the resources needed to print the critical document but
18 also the resources needed to print the three non-critical documents pending in
19 the print server. However, in most instances, as described above, the user is
20 interested in determining only whether the critical document(s) will be
21 successfully printed. As a result, a device capable of calculating the resources
22 necessary to successfully print all of the pending documents regardless of their
23 criticality would require an unwarranted level of computational complexity.

24 Thus, there is a further need in the art for a device that is
25 compatible with conventional computer network configurations that utilize
26 print servers to control printing tasks and that is capable of estimating the
27 printer resources needed to successfully print selected documents, such as, for
28 example, critical documents.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a block diagram of a printer coupled to a stand-alone computer having a job assurance logic (JAL) unit for estimating printer resources;

FIG. 2 is a block diagram of a printer and printer driver coupled to a network computer system that includes a computer having a JAL unit for estimating printer resources;

FIG. 3 is a block diagram of a JAL;

FIG. 4 is a flow chart that illustrates a method for implementing a JAL unit in a stand-alone computer system in accordance with the present invention; and,

FIG. 5 is a flow chart that illustrates a method for implementing a JAL unit in a network computer system in accordance with the present invention.

SUMMARY OF THE INVENTION

The present invention is directed to a unit that estimates the printer resources required by a printer to print a critical document and that alerts a user who sent the document to the printer in the event that insufficient resources are available to print the document. The device may be used in a computer system having a stand-alone computer coupled to a printer and may further be used in a network computer system having a computer coupled to a computer network that uses a print server to control a printer.

DETAILED DESCRIPTION

Referring now to FIG. 1, a stand-alone computer 10 includes a central processing unit (CPU) 12 coupled to a memory 14 and further coupled to a print driver 16. The print driver enables communication between the CPU 12 and a printer 18 via a printer cable 20. Print drivers are well known in the

1 art and are conventionally implemented using software. As a result, the details
2 of the print driver are not discussed further herein. A monitor 22, keyboard 24
3 and mouse 26 enable communication between a user and the CPU 12.
4 Although not shown in FIG. 1, the computer 10 may further include any
5 number of peripheral devices, for example, a modem, a sound card, a video
6 card, etc. In addition, the printer 18 may be implemented using a laser jet
7 printer, an inkjet printer, or any other device that may be used to print a
8 document.

9 A job assurance logic (JAL) unit 28 disposed in the computer 10
10 is coupled to, and communicates with a software extension of the print driver
11 16, referred to as a missile 29, and further communicates with a ping device 30
12 disposed in the printer 18, via the print driver 16. The missile extension 29 of
13 the print driver 16 and a printer having a ping device 30 disposed therein are
14 both commercially available from Hewlett Packard ® and are used to enable
15 direct communication between the printer and the computer 10. The missile
16 extension 29 is implemented using software code and the ping device 30 is
17 implemented in the printer 18 using firmware. The reader is directed to U.S.
18 Patent Application Serial No. _____ (Attorney Docket no. 10990543-1),
19 incorporated in its entirety by reference herein, which describes a print job
20 language that the ping 30 and missile 29 devices may use to communicate.
21 More particularly, conventional computers and printers are typically designed
22 for uni-directional communication wherein the computer is capable of
23 transmitting communications to the printer, but the printer, a passive device,
24 does not transmit information to the computer and is not even informed as to
25 the address of the computer. The print job language described in the above-
26 referenced patent application enables two-way communication between a
27 printer and a computer by providing the address of the computer to the printer
28 so that the printer may transmit information back to the computer, if desired.
29 Specifically, the missile extension 29 generates a print job language command,

1 known as a socketping command, that includes a set of fields including a field
2 containing the address of the computer 10 to enable bi-directional
3 communication and may further include any number of extension fields
4 designated to provide additional instructions to the printer 18. To enable
5 operation with the job assurance logic unit 28 described herein, the socketping
6 command will include an extension field designated to contain, and containing
7 an instruction to transmit the requested information, i.e., the printer resource
8 information.

9 Referring now to FIG. 2, the computer 10 of FIG. 1, may instead
10 be coupled to a computer network 31 that includes a plurality of user
11 computers 32 coupled via a communication network 34 and further includes a
12 network server 36, also coupled to the communication network 34, for
13 controlling communication on the network 34. As will be understood by one
14 having ordinary skill in the art, the communication network may be
15 implemented using a hard-wired network or may instead be implemented via a
16 wireless communication medium in which case each of the computers 10, 32
17 will include equipment for interfacing with a wireless communication network.
18 In addition, one or more of the computers 10, 32 may be coupled to the
19 network remotely via a telephone connection established using a modem. A
20 printer 38 and print server 40 are further coupled to the communication
21 network 34 and perform printing tasks to provide print capabilities to the user
22 computers 32 and to the computer 10 coupled to the network 34. As is
23 conventional, the print server 40 may be implemented with a computer that is
24 programmed to temporarily store a set of documents for printing and to control
25 the order in which the documents are supplied to the printer 38.

26 Each of the user computers 32 may include, for example, a
27 central processing unit 41 coupled to a memory 43 and to a print driver 45.
28 The print driver 45 disposed in each user computer is further coupled to the
29 printer 38 and print server 40 via the network 34. Of course, each of the user

1 computers 32 may further include a set of apparatus by which a user may
2 communicate with the computers 32 including, for example, a monitor, a
3 keyboard and a mouse, or may include any other desired peripherals or features
4 (not shown).

5 Referring now to FIG. 3, the JAL 28 disposed in the computer 10
6 is coupled to the print driver 16 and may include a converter 42 for converting
7 information received from the print driver 16 into a common unit system. The
8 information may include, for example, a first set of values that represent the
9 amount of resources required to print a document and a second set of values
10 that represent the amount of resources available at either of the printers 18, 38.
11 The converter 42 is further coupled to a comparator 44 that receives the
12 converted information, i.e., the first and second sets of values, and then
13 compares the sets of values. More particularly, the value from the first set
14 representing a first required resource may be compared to the value from the
15 second set that represents the amount of the first resource that is available. The
16 comparator 44 is further coupled to an indication signal generator 46 that
17 causes an alert message to be generated in the event the comparisons performed
18 at the comparator 44 reveal the amount of resources available at the printer 18
19 or 38 are insufficient to print the document. The converter 42, comparator 44
20 and indication signal generator 46 are further coupled to and controlled by a
21 controller 48. As will be understood by one having ordinary skill in the art, the
22 converter 42, the comparator 44, the indication signal generator 46 and the
23 controller 48 may be implemented using hardware, software, firmware or a
24 combination thereof.

25 More particularly, and referring still to FIG. 3, the controller 48
26 disposed in the JAL unit 28 that is associated with the computer 10 may be
27 implemented using, for example, software code that when executed by the CPU
28 12 or any other computer processor, causes a method for estimating printer
29 resources to be performed. In addition, the software code may vary depending

1 on whether the JAL unit 28 is associated with the stand-alone computer 10 of
2 FIG. 1 or with the computer 10 coupled to the communication network of FIG.
3 2.

4 Referring also to FIG. 4A, when associated with the stand-alone
5 computer 10, the method may begin, for example, when a user selects a job
6 assurance logic feature while operating a software application such as for
7 example, a word processor, or a spreadsheet software package (step 50). Of
8 course, the software application is embodied in a set of computer codes that are
9 executed by the CPU 12. In one embodiment, selecting the print job assurance
10 feature may be performed by using the mouse 26 to check a box appearing in a
11 print information dialog window or screen display. The print information
12 dialog window refers to any display of information that typically appears on
13 the computer monitor 22 when a print feature associated with the software
14 application is selected by which the user may specify print information. The
15 print information specified is then used by the print driver 16 to generate an
16 appropriate set of print commands that are subsequently transmitted to the
17 printer 18. The print information dialog window may include, for example, a
18 set of data fields that prompt the user to enter information that is required to
19 enable printing. When the required information has been entered, the user may
20 then select a print button appearing in the window using, for example, the
21 mouse 26 or a hotkey. In response to selecting the print button, the print driver
22 16 uses the required information entered by the user to generate the appropriate
23 set of print commands which are then sent to the printer 18 to thereby enable
24 printing of the document. Such information may include, for example, the
25 number of pages to be printed, the number of copies of the document to be
26 printed, and whether the printed copies are to be collated or uncollated. When
27 used in conjunction with a JAL unit 28, the print dialog window may further
28 include, for example, a check box that, if checked by the user, causes the print
29 driver 16 to invoke the JAL unit 18.

1 If the job assurance check box is checked such that the JAL unit
2 28 is invoked, the controller 48 causes the print driver 16 to request print
3 information, from the software application, about the document to be printed
4 (step 60). Such print information may include, for example, the number of
5 pages to be printed and the characters to be printed per page. If the document
6 includes one or more graphics, then the print information may further include
7 the number and size of the graphics to be printed.

8 Next, the driver 16 receives the requested information provided
9 by the software application and transmits the requested information to the JAL
10 unit 28 where it is subsequently delivered to the converter 42 (step 70). As will
11 be understood by one having ordinary skill in the art, the information may not
12 actually be transmitted but may be stored in the memory 14 and the print driver
13 16 may inform the controller 48 as to the location at which the information is
14 stored in the memory 14 so that the controller 48 can access the information.
15 After having delivered the print information to the JAL 28, the controller 48
16 causes the driver 16 to request printer resource information from the printer 18
17 (step 80). The printer resource information may include, for example, the
18 amount of toner left in the printer cartridge and may further include the number
19 of pages of paper remaining in the printer 18.

20 In response to the request, the ping firmware 30 transmits the
21 printer resource information to the missile extension 29 of the print driver 16
22 (step 90), and then the print driver 16 causes the printer resource information
23 received from the ping firmware 30 to be transmitted to the JAL unit 28 where
24 it is subsequently delivered to the converter 42 (step 100). Referring also to
25 FIG. 4B which aligns with FIG. 4A at connecting points A and B, next the
26 controller 48 causes the converter 42 to convert the document print information
27 and the printer resource information into the same units, if necessary, so that
28 the information can be directly compared (step 110). After the information has
29 been converted, the controller 48 causes the comparator 44 to compare, for

1 example, the number of pages required to print the document to the number of
2 pages of paper remaining in the printer (step 120). In addition, the controller
3 48 causes the comparator 44 to compare the amount of toner left in the printer
4 cartridge to the amount of toner required to print the document (step 120).
5 Provided that sufficient resources are available, the controller 48 causes a flag
6 associated with each resource to be set (step 130). If instead sufficient
7 resources are not available, then the controller clears the flag associated with
8 the insufficient resource (step 130). As will be understood by one having
9 ordinary skill in the art, at times, pages of paper stored in a printer paper tray
10 may sometimes become stuck together causing more than a single sheet of
11 paper to be routed through the printer 18 at a single time. As a result, although
12 the printer 18 originally had sufficient paper to successfully print the
13 document, the sheets that are routed through the printer together may deplete
14 the paper resources causing the originally sufficient resources to be insufficient
15 to successfully print the document. To ensure that this does not occur, the
16 comparison flag indicating whether sufficient resources are available may, if
17 desired, only be cleared in the event that the amount of available resources
18 exceeds the amount of required resources by a predetermined amount. If the
19 amount available does not exceed the amount required by this predetermined
20 amount, then the controller 48 sets the flag to indicate that insufficient
21 resources are available to successfully complete the print job. For example,
22 when making the comparison, the comparator 44 may compare the amount of
23 resources available to the amount of resources required, plus the predetermined
24 amount. If the amount of resources available exceeds the amount of resources
25 required by at least the predetermined amount, then the controller 48 clears the
26 flag, if not, the controller 48 sets the flag.

27 Next, the controller 48 determines whether the printer 18 has
28 sufficient resources to successfully print the document by checking the status
29 of the flag (step 140). In the event the flag is cleared indicating sufficient

resources are available, then the controller 48 causes the print driver 16 to transmit the document to the printer 18 with an appropriate set of print command codes to be used by the printer 18 print the document (step 160). If instead, the controller 48 determines the flag is clear indicating sufficient resources are not available, then the controller 48 causes the print driver 16 to generate a message for display on the monitor 22 that alerts the user about the insufficient resources (step 150). The content of the displayed message may take a variety of formats. For example, the message may specify which of the printer resources is insufficient. Or, the message may simply specify that insufficient resources are available without specifying which resource is depleted. In addition, the message may instruct the user to check and/or replenish the insufficient printer resource(s). As will be understood by one having ordinary skill in the art, identifying which of the printer resources is insufficient may not be necessary because the user may be able to make such a determination by checking the contents of the paper tray and if full, assuming that the toner is insufficient or if low, assuming that the paper tray needs to be filled. One having ordinary skill in the art will further understand that instead of generating a message for display, the controller 48 may cause the driver to generate any type of signal to alert the user to the insufficient resources including an audible message or a printed message.

In addition, the alert message may include a mechanism by which the user may respond to the message. For example, the message may include two buttons selectable using the mouse 26, a first of which allows the user to ignore the insufficient resources warning and print the document (step 160), and a second that allows the user to cause the JAL unit 28 to check the availability of the printer resources again (step 170 and steps 80-140). For example, assuming the message has been generated and the user, after inspecting the printer 18, has identified and rectified the resource deficiency, the user may then elect to check the resources again by pressing the second

1 button. If the second button is pressed, the controller 48 again requests printer
2 resource information from the printer (step 80) and repeats the process
3 described above (steps 80-140), thereby causing the JAL unit 28 to again check
4 the sufficiency of the resources available at the printer 18. If the resource
5 deficiency has been rectified, then the method will terminate when the
6 controller 48 causes the driver 16 to send the document to the printer 18, and if
7 the resource deficiency has not in fact been rectified, then the controller 48 will
8 again cause the print driver 16 to generate a message alerting the user to the
9 deficiency.

10 Referring also to a FIGs. 5A and 5B which align at connecting
11 points A and B, the JAL unit 28 may be modified for operation in the computer
12 network 34 of FIG. 2 by additionally programming the controller 48 to cause
13 the print driver 16 to command the printer 38 to switch from a client server
14 mode to a direct printing mode (step 55) after the print assurance feature has
15 been selected (step 50) and before the driver 16 requests print information
16 about the document to be printed (step 60). While in the client server mode,
17 the printer 38 performs print tasks in an order by which the tasks are supplied
18 by the printer server 40. As is well-known in the art, the print server 40 may be
19 programmed to supply print jobs to the printer 38 in an order in which they are
20 received by the print server 40 or may instead be programmed to supply print
21 jobs to the printer 38 according to a priority level associated with the
22 documents received at the print server 40. For example, all documents having
23 the highest priority level may be printed before the lower priority level
24 documents and documents having the same priority level may be supplied to
25 the printer 38 according to an order in which they are received at the print
26 server 40. In contrast, when switched to the direct printing mode, the printer
27 38 communicates with and performs printing tasks for only the user computer
28 10 from which the direct printing mode command was received. Thus, when
29 the direct printing mode command is issued by the driver 16, the printer 38

1 stops responding to print commands issued by the print server 40 and instead
2 communicates exclusively with the user computer 10 having the print driver 16
3 that issued the direct printing mode command. As described above, the JAL
4 unit 28 may instruct the printer 38 to switch modes using a socketping
5 command that includes a field designated to include an appropriate mode
6 switching instruction. In addition, one having ordinary skill in the art will
7 recognize that conventional printers typically include a mode switching
8 capability and will further recognize that printers not equipped with such a
9 mode switching capability may easily be programmed or otherwise modified to
10 include such a capability.

11 After the direct printing mode command has been issued by the
12 driver 16, the method continues as described above. In addition, after the
13 controller 48 causes the driver 16 to send the document to the printer 38 for
14 printing (step 160), the controller 48 causes the driver 16 to command the
15 printer 38 to switch from the direct printing mode back to the client server
16 mode thereby causing the printer 38 to again respond to print commands issued
17 by the print server 40 (step 165).

18 From the foregoing description, it should be understood that an
19 apparatus and method for estimating printer resources have been shown and
20 described, both of which have many desirable attributes and advantages. The
21 JAL unit 28 ensures that sufficient printer resources are available prior to
22 printing a document thereby reducing the potential for wasted time and wasted
23 resources. Specifically, the risk of sending a document to the printer, only to
24 discover that the document is either illegible due to low print toner, or is
25 missing pages because of a low paper supply, is minimized. Moreover, the
26 method allows a user to temporarily switch the mode of printer operation from
27 the client server mode to the direct printing mode thereby causing the JAL unit
28 28 to be compatible with computers 10, 32 that are coupled to a computer
29 network 31 and thus share print resources. In addition, the direct printing mode

1 allows the user to ensure that a document having a high priority is completely
2 and legibly printed without delay.

3 While various embodiments of the present invention have been
4 shown and described, it should be understood that other modifications,
5 substitutions and alternatives are apparent to one of ordinary skill in the art.
6 For example, although the JAL unit 28 is shown as being disposed in the
7 computer 10, the JAL unit 28 may instead be located outside of the computer
8 10. In addition, although the JAL unit 28 is described as determining resources
9 necessary to print a document generated by a word processor software
10 application or a spreadsheet software application, the JAL unit 28 may perform
11 the same function for documents printed by any software application that is
12 capable of generating a document to be printed. Further, although the print
13 assurance feature that invokes the JAL unit 28 is described as being selected
14 using a print dialog window the feature may alternatively be selected using any
15 software feature selection method. For example, software features are
16 selectable using a pull-down menu, a mouse click and a touch screen. Further,
17 if the first value representing the amount of printer resource required to print
18 the document and the second value representing the amount of the printer
19 resource available at the printer both are provided to the controller 48 in a
20 common unit of measure, then the converter need not perform any conversion.
21 Likewise, if the first and second values are always provided in a common unit
22 measure then the converter need not even be included in the JAL unit 28. In
23 addition, although the print driver 16 and printer 18, 38 are described as
24 communicating via the missile extension 29 and ping device 30, the print driver
25 16 and printer 18, 38 may instead communicate using any suitable
26 communication device implemented using software, hardware, or any
27 combination thereof. Such modifications, substitutions and alternatives can be
28 made without departing from the spirit and scope of the invention, which
29 should be determined from the appended claims.

- 1 Various features of the invention are set forth in the appended
- 2 claims.